

Conceptual

1) (A)

$$2) R = \frac{\rho L}{A} \quad \times 4 = 4R = \frac{\rho 4L}{\pi r^2} = \frac{4\rho L}{(2r)^2 \pi} = \frac{4\rho L}{4r^2 \pi} = \frac{\rho L}{\pi r^2}$$

$r = \frac{1}{2}d$   
 $2r = d$        $2 \times r = 2 \times d$       (d)

$$3) R = \frac{\rho L}{A} : \times \frac{1}{2} = \frac{\rho \frac{1}{2}}{A(\frac{1}{2})^2} = \frac{\rho \frac{1}{2}}{A(\frac{1}{4})} = \frac{\frac{1}{2}}{\frac{1}{4}} = \frac{4}{2} = 2r$$

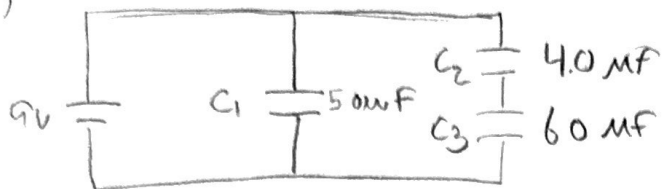
$d = 2r$       (b)

$$4) P = I^2 R$$
$$= \frac{(\Delta V)^2}{R}$$

$R$  increases  $\therefore P$  decrease

(b)

5) (A)



Series:  $\frac{1}{C}$

Parallel:  $C_1 + C_2 + C_3$

a.)  $\frac{1}{4\mu F} + \frac{1}{6\mu F} = C_2 + C_3 = 2.4\mu F$   
 $50\mu F + 2.4\mu F$   
 $C_1 + (C_2 + C_3) = 7.4\mu F$

$C_{eq} = 7.4\mu F$

b.)  $C = \frac{Q}{\Delta V}$

$Q = 7.4\mu F (9V) = 66.6\mu C$

$C_1 = 50\mu F$   
 $C_4 = 7.4\mu F$

$C_1 = \frac{Q}{\Delta V}$

$C_4 = \frac{Q}{\Delta V} \quad C_4 = 2.4\mu F$

$Q = 45\mu C$

$Q = 21.6\mu C$

$Q_1 = 45\mu C$   
 $Q_{eq} = 22\mu C$

c.)  $C_4$ :  $C_2 = \frac{Q}{\Delta V} \quad Q = 21.6\mu C$   $C_3 = \frac{Q}{\Delta V} \quad Q = 21.6\mu C$   
 $\Delta V = \frac{Q}{C_2} \quad C_2 = 4.0\mu F$   $\Delta V = \frac{Q}{C_3} \quad C_3 = 6.0\mu F$   
 $\Delta V = 5.4\Delta V$   $\Delta V = 3.6\Delta V$

$C_1$ :  $C_1 = \frac{Q}{\Delta V} \quad Q = 45\mu C$

$\Delta V = \frac{Q}{C_1} \quad C_1 = 5\mu C$

$\Delta V = 9V$

$C_1 = 9V$   
 $C_2 = 5.4V$   
 $C_3 = 3.6V$

2.)  $\Delta V = 15 \text{ V}$   $L = 120 \text{ m}$   $\rho = 2.4 \times 10^{-8} \Omega \text{ m}$   $d = 0.15 \text{ mm}$

a)  $R = \frac{\rho L}{A}$   $R = 162.975 \Omega$   $\frac{\Omega \text{ m (m)}}{\text{m}^2} = \Omega$

$A = \pi \left( \frac{1.5 \times 10^{-3}}{2} \right)^2$

[o]  $A = (5.625 \times 10^{-7} \text{ m}^2)$

b)  $I = \frac{\Delta V}{R}$   $\Delta V = 1.5$   $R = 162.975 \Omega$

$I = 0.009204 \text{ A}$

c)  $J = \sigma E$

$\sigma = \frac{1}{\rho}$   $\sigma = 4.16 \times 10^7 (\Omega \text{ m})^{-1}$

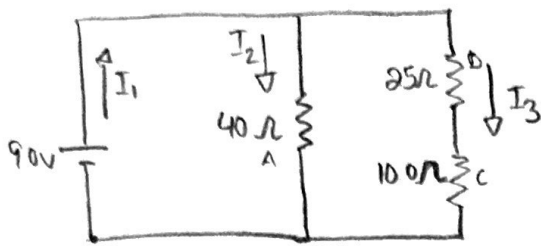
$J = \frac{I}{A} = \frac{0.009204 \text{ A}}{\pi (0.075 \text{ mm})^2} = \boxed{J = 520,833 \text{ A/m}^2}$

d)  $J = \sigma E$

$E = \frac{J}{\sigma} = 1.25 \times 10^{-2} \text{ V/m}$

$E = 1.25 \times 10^{-2} \text{ V/m}$

3.)



$$I_1 = I_2 + I_3$$

a)  $B+C = 35\Omega$

$$A + (B+C)$$

$$\frac{1}{40\Omega} + \frac{1}{35\Omega} = \left(\frac{3}{56\Omega}\right)^{-1} = 18.67\Omega$$

$$R = 18.67\Omega$$

b)  $9.0V - I_1(18.67\Omega) = 0$

$$I_1 = 0.482A$$

$$\therefore 9.0V - I_2(40\Omega) = 0$$

$$I_2 = 0.225A$$

$$\therefore 9.0V - I_3(35\Omega) = 0$$

$$I_3 = 0.257A$$

$$I_1 = 0.482A$$

$$I_2 = 0.225A$$

$$I_3 = 0.257A$$

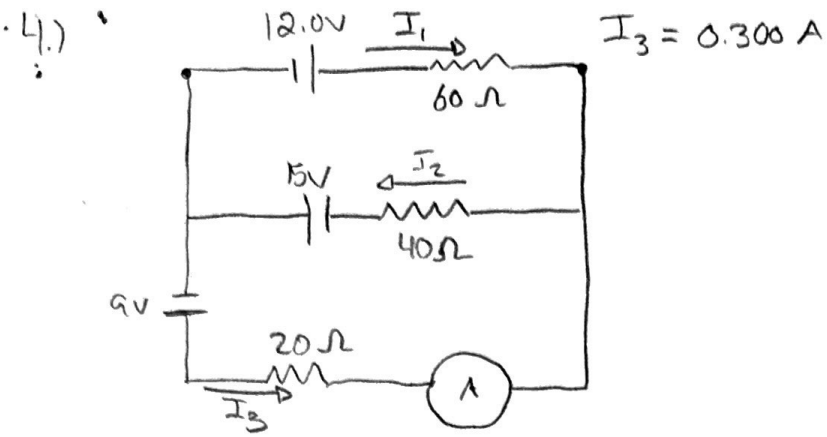
c.)

$$P = I^2 R$$

$$I = 0.225A$$

$$R = 40\Omega$$

$$P = 2.025W$$



loop 1

$$12\text{V} - I_1(60\Omega) + I_3(20\Omega) - 9\text{V} = 0$$

$$-I_1(60\Omega) + 9\text{V} = 0$$

$$I_1 = 0.15 \text{ A}$$

loop 2

$$12\text{V} - I_1(60\Omega) - I_2(40\Omega) + 15\text{V} = 0$$

$$-I_2(40\Omega) + 18\text{V} = 0$$

$$I_2 = 0.45 \text{ A}$$

$$I_1 = 0.15 \text{ A}$$

$$I_2 = 0.45 \text{ A}$$

$$I_3 = 0.300 \text{ A}$$